Variability of $PM_{2.5}$ concentrations in the Charleston Neck

A3 Distribution List

Copies of the approved QAPP and any revisions will be provided to:

		Organization
Susan Yates	Manager, Field Operations	EQC Region 7
Scott Reynolds	Project Manager, QAPP maintenance and distribution	Division of Air Quality Analysis
Robert Schilling	Lab Manager, Lab Operations	Division of Air Quality Analysis
Eleanor Marra	Analyst	Division of Air Quality Analysis
Rhonda Thompson	Asst. Bureau Chief	Bureau of Air Quality
Nydia Burdick	EQC QA Officer	Office of Quality Assurance

A4 Project Organization:

Project Management

Scott Reynolds, Project Manager

Analytical Operations

Robert Schilling, Project and DAQA Analytical Section Manager – laboratory analysis and report coordinator

Eleanor Marra, DAQA Chemist – gravimetric analysis, reporting

Jim Leinart - Technical Support Section Manager- sampler configuration and installation.

Field Operations

Susan Yates, EQC Region 7 –Field Manager, sample collection.

Anna Eskridge, EQC Region 7 – sample collection.

Wendy Boswell, EQC Region 7 – sample collection

Michael Ward, EQC Region 7 – sample collection

Field Quality Assurance

Kevin Watts - Audit and Calibration Section Manager, audit and calibration coordinator

Data Management

John Schrenk, Data Management Section Manager

The Project Manager will provide oversight of the complete project and will coordinate project and laboratory activities with the field operations conducted by the EQC Regional Office.

A5 Background:

The Charleston Neck is a mixed industrial and residential area bounded on the east and west by the Cooper and Ashley Rivers, respectively. The relatively recent redevelopment of the former Naval Base and in particular the planned State Ports Authority (SPA) facility and related

modifications of the major road systems have raised concerns about current and future impacts on air quality in the existing communities. The SPA has agreed to provide funding to establish and support an ambient air monitoring site in the Charleston Neck.

One of the primary concerns related to the port expansion is fine particle pollution exposure of residents in the existing local neighborhoods. There are health based National Ambient Air Quality Standards (NAAQS) for fine particulate less than 2.5 microns ($PM_{2.5}$). The standards address short term and chronic exposures with 24-hour and annual standards. SC DHEC has monitored $PM_{2.5}$ concentrations in the Charleston area since late 1998, using Federal Reference Method (FRM) samplers at sites near the city center(CPW) and in a suburban area (FAA). The CPW site also hosts a National Speciation Trends Network sampler that provides information about the composition of the fine particulate and a continuous monitor that provides data for near real-time reporting to the public. Neither site has indicated ambient concentrations near the level of the annual standard. Concentrations at the two existing sites have been similar and highly correlated (r^2=.9), indicating the sites are representative of the greater Charleston area. There has been some concern that the current monitoring does not adequately represent the potentially higher concentrations in the Neck area where there is a concentration of industry, port activity and traffic.

National Ambient Air Quality Standards for $PM_{2.5}$		2005-2007 Design Value	
		CPW	FAA
Annual	15 $\mu g/m^3$	11.2	12.0
24 Hour	35 $\mu g/m^3$	25	27
$\mu g/m^3$- Micrograms per Cubic Meter			

The Design Value is the metric specified for comparison of ambient concentrations with the standard and is an average of three years data (for comparison to the annual standard) or three year's 98^{th} percentile maximum concentration (for comparison to the 24-hour standard).

In response to community concerns about the representativeness of the one SPA supported monitoring site for the neck and the best location for the site, this study is intended to provide preliminary and more spatially detailed information about the $PM_{2.5}$ concentrations relative to the existing sites and within the potentially impacted neighborhoods.

A6 Project Description:

The primary objective of the sampling is to determine the spatial variability of the $PM_{2.5}$ concentrations in the residential areas of the Charleston Neck and collect sufficient samples to provide representative measurements of $PM_{2.5}$ in the Charleston Neck communities during the project period. The data will permit an evaluation of potential differences in concentration within and between populated communities and the correlation of local concentrations with concentrations at the existing monitoring sites.

The US EPA encourages State and local air pollution control agencies to conduct short-term, multi-site pollutant monitoring studies using a technique known as saturation monitoring. Saturation monitors are typically non-reference method, small portable samplers which are readily set-up, operated, and relatively easy to site. Because the small samplers are relatively inexpensive, it is possible to "saturate" an area to assess air quality where more spatially detailed

pollutant concentration data are appropriate to address specific questions. Saturation monitors may be used to determine "hot spots", - areas of relatively higher fine particulate concentration but that is not the intent of this project. . The saturation study data is expected to provide preliminary information for representative, longer term sampler siting and assist the evaluation and development of a representative monitoring network for the Charleston area.

To accomplish this objective, a sufficient number of valid sample sets (samples collected concurrently at the project sites) will be collected over the project period to compare the concentration means with a confidence of 90% or better. If possible, wind speed and direction data will be collected at one or more locations to provide an indicator of mixing conditions, relative position of the sampling site to local source areas and local air movement during sampling.

Comparisons of the mean ambient concentrations of $PM_{2.5}$ at each site will be reported as an indicator of the variability of concentrations in the study area during the project period.

Activity	Organization	Expected Initiation	Expected Completion
QAPP Approval	DAQA	July, 2008	July, 2008
Sampler acquisition	DAQA/ EPA		
*Sampler evaluation	DAQA	April, 2008	July 15, 2008
Site identification, acquisition, and installation	DAQA	March 12, 2008	July 15, 2008
Sampling	Region 7/DAQA	July 15, 2008	November, 2008
Report	DAQA	-	January, 2009

* Related activity that may impact project Schedule

A7 Quality Objectives and Criteria

The portable samplers that will be used for the study have been evaluated to estimate the precision and bias compared to a Federal Reference Method measurement. As expected, the data quality is not sufficient to meet the FEM requirements (40 CFR§ 53) but are expected to be adequate to meet the project goal of determining if there are significant concentration differences between the communities[1]. The method evaluation includes variability resulting from sampler and analytical random and systematic bias.

Sample handling and analysis for the $PM_{2.5}$ samples will be consistent with existing methods used in the Division of Air Quality Analysis and described in the Quality Assurance Plan: Ambient Air Quality Monitoring and its Appendices.

Criteria required for valid Particulate Matter 2.5 microns and less ($PM_{2.5}$) collection is specified in Quality Assurance Plan for the $PM_{2.5}$ Ambient Air Monitoring Program Section 11.

[1] Method Estimates of Precision (8%) and Bias: Slope (.95), Intercept (3.83), r=0.05, CCV= 0.27 referenced to FRM

Criteria required for valid gravimetric filter analysis is specified in Section13 of the same document.

In general, for any sample to be considered valid and acceptable for use, the sampler should have operated for 24 hours ±1 hour, no unusual event or local activity such as a nearby fire, should impact the sample, scheduled flow audits should meet the criteria specified for the sampling method, and all instrumental QA should meet the criteria specified by the analytical method.

Data quality is expected to be comparable to that of the SC ambient monitoring network and the data, taking into account the precision and bias documented for the saturation samplers, reasonably comparable to that collected elsewhere within the network. The measurement system precision (combination of sampling and analysis) will be characterized prior to project iniation.

B1-B7 Sampling and Analysis Design and Requirements:

The sampling locations will be planned with cooperation of the communities, focusing on residential neighborhoods in the area defined in the project area map. In general, sampling sites will be away from community edges (interface between residential and commercial and industrial areas) and identified local sources and meet as many of the $PM_{2.5}$ monitoring siting criteria as possible. Five sampling sites are expected to be operated, distributed among the project area communities.

Sampling events - days when all samplers are scheduled to operate- will coincide with the national 1 in 3 day schedule. Sampling at each site will begin on the first possible scheduled sampling day after sites are identified, secured and the sampling system is installed and will be terminated when there are sufficient samples (based on the sampling precision) to reasonably compare the means and variability between sites. It is expected the at least 20 sample sets (sampling events during which a majority of the operating samplers provide valid data) will be required (approximately two months of sample collection at the 1:3 sample schedule). Samples collected during periods of heavy or prolonged precipitation may not be counted toward the necessary sample sets. If there are delays in site setup or operational problems that prevent sufficient sample collection to meet data needs additional sample events at specified sites may be scheduled by the project manager in coordination with the laboratory to achieve a sufficient quantity of valid sample sets.

The duration of each sample collection event will be 24 hours (±1 hour, midnight to midnight EST). Start and stop time will be controlled by the individual sampler controllers.

$PM_{2.5}$ sample media installation, collection, and transport will be performed consistent with the intent of procedures within Section 12.6 of the EQC Environmental Investigations SOP. Sampler specific SOPs may be developed to describe and define significant equipment related differences in the field and sampling procedures. Gravimetric analysis of the particulate matter filter samples will be performed according to Appendix AV.

The flow calibration for the low volume saturation samplers will be performed on site after installation and flow audits will be conducted approximately every 2 weeks and at the conclusion of the project sampling to verify sampler performance and total flow calculations.

Meteorology

If an appropriate site is available, continuous wind speed and direction measurements will be collected at a sampling site or in a representative area during the project sampling period. If wind speed and direction measurements cannot be made as part of the project, available National Weather Service data for Charleston during the sampling events will be used as an indicator of project area weather conditions during sampling.

D2 Validation and Verification Methods

The limited scope of the sampling and reporting will allow appropriate limitation of the verification activity to a review of the sample documentation and analytical QC. Quality assurance of the sampling and analytical processes and data will be performed consistent with the Ambient Air Monitoring QAPP and Appendix AT, Appendix AU, and Appendix AV.

Characterization of the method performance prior to sampler performance will be used to describe the expected performance of the method. Collocated sampling may be used during the project as a check of continued sampler performance and confirmation of analytical precision.

All data will be evaluated and verified by the primary analysts according to quality assurance defined in the appropriate method Appendix of the Ambient Air Quality Monitoring QAPP:

Parameter	Reference Method
Particulate Matter PM2.5 FRM sampler	Appendix AT or AU
PM 2.5 Lab Procedures	Appendix AV

The Project Manager, prior to submission of a final project report will validate all data. The validation of the data will include checks of the accuracy of calculations and review of all the final data to identify any anomalies. Any anomalies identified during the validation process will be investigated for possible causes or explanations by a thorough review of all supporting data (flow audits, meteorological, chain of custody, instrument QA/QC, field blank data, precision data derived from replicate analyses, etc.). Depending on the results of the investigation and the severity of the anomaly, data may be excluded from summary statistics or identified as suspect but included in the report conclusions. All verified data and associated Quality Assurance flags will be included in the final report.

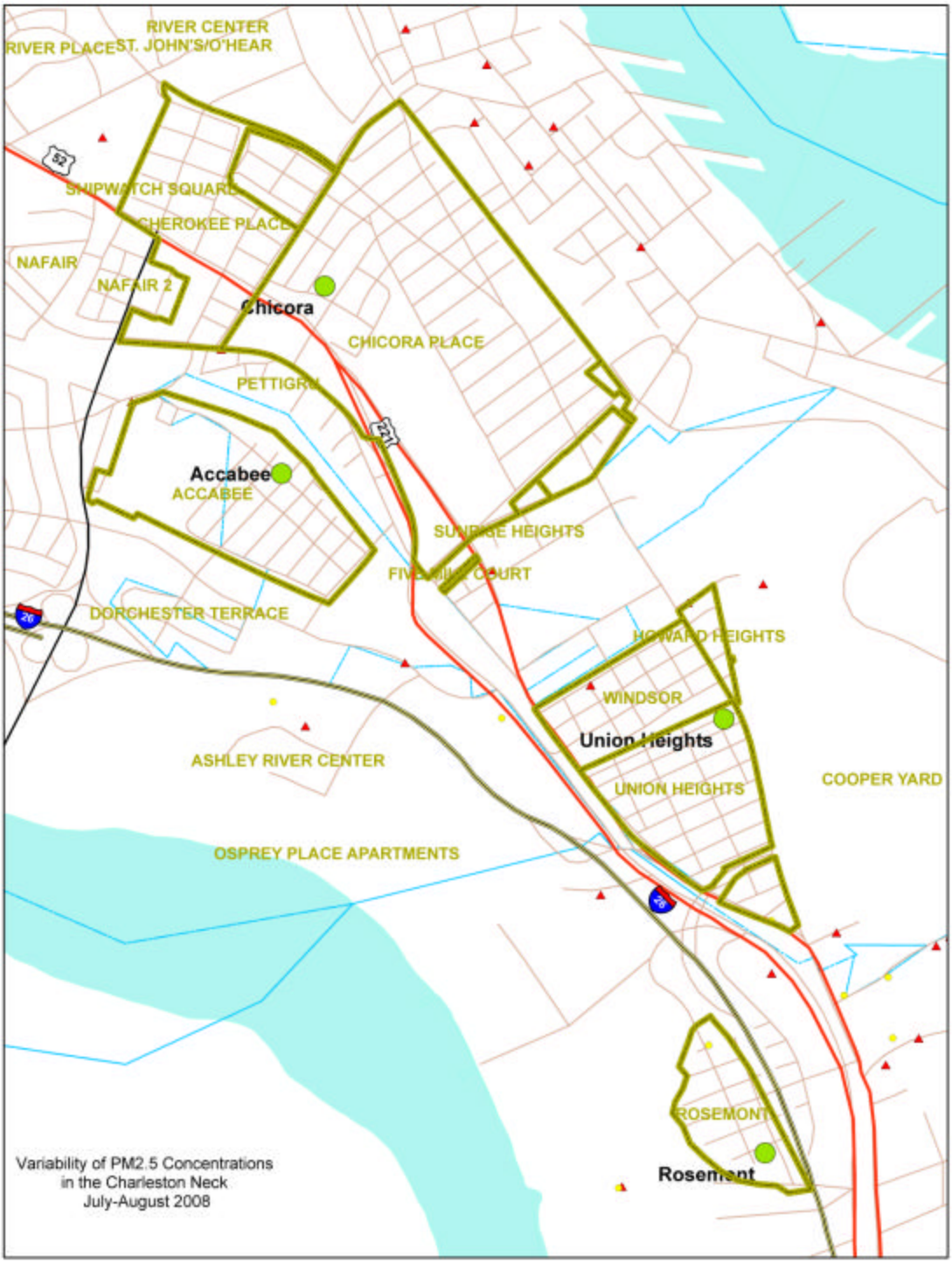
Fine particulate data collected using the Federal Reference Method samplers collected at the CPW and FAA monitoring sites (AIRS sites 45-019-0049 and 45-019-0048) will be used for comparison and context.

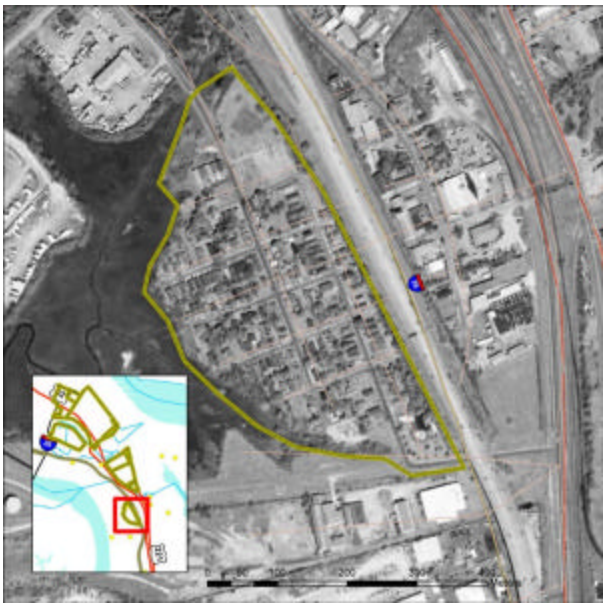
The summary statistics used will depend on the characteristics of the dataset, but will include:

- concentration mean and range for the project area for each sampling event
- concentration mean and range for each of the sampling locations for the project period
- correlation of daily concentrations between each site and the average area concentration as measured using the Federal Reference Method at the existing Charleston area network sites.

Project Area

The project area includes the communities of Rosemont, Silver Hill, Four Mile, Five Mile, Union Heights, Howard Heights, Chicora-Cherokee, Accabee and Windsor. Approximate project sampling locations are indicated. Location maps for the specific sites will be appended to this plan as specific monitor sites are identified.





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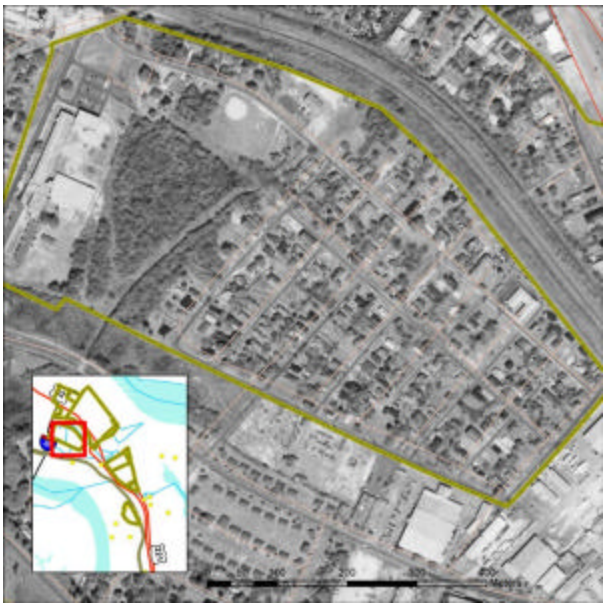

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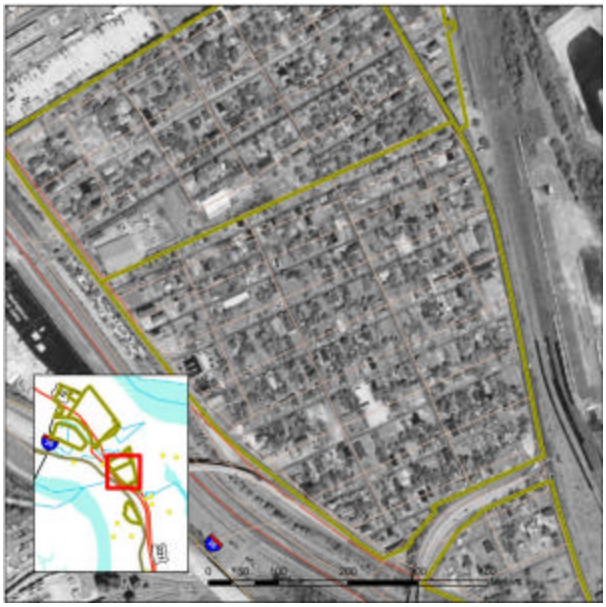
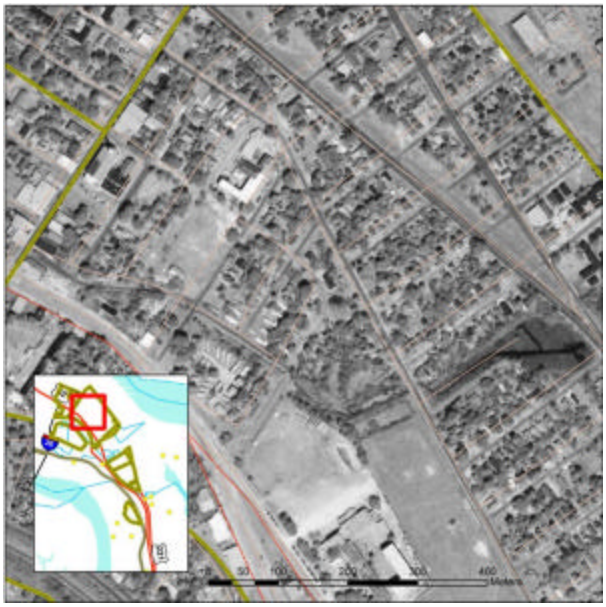


Union Heights



Chicora